



THE ECONOMIC ANALYSIS IN THE WATER FRAMEWORK DIRECTIVE: THE SPANISH CASE IN THE EUROPEAN CONTEXT

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Abstract

This paper describes the current state of implementation of the economic analysis prescribed by the Water Framework Directive (WFD) in Spain. It also outlines what should be the policy and research priorities for economic analysis in the coming years. The economic characterization of water services, and the theoretical and practical debate about the cost recovery principle and the role of water pricing as an efficient instrument for water demand management constitute significant progress. However, challenges do remain regarding the calculations for cost recovery and water pricing, such as the inclusion of environmental and resource costs. Other elements of the economic analysis also require further improvement. Cost-effectiveness analysis needs to be more fully applied to the Programs of Measures, and cost-benefit analysis will have to play a key role in the assessment about derogations from the required environmental objectives for certain water bodies. Two further remaining challenges are the incorporation of uncertainty in for instance cost calculations and the modeling of future water supply and demand, and the estimation of the cost of adaptation to climate change.

Key words: Water Economics, water pricing, cost efficiency analysis, uncertainty.

1. INTRODUCTION

The Water Framework Directive (WFD) is an environmental norm aimed at sustainable water management and the protection of water bodies (Directive 2000/60/EC). The enactment of the WFD was the culmination of a process that started in the 80's and 90's. Its main objective is to create coherent European water regulation and reach a good environmental status in all European water bodies. The importance of the Directive is reflected in the intense debate that has

surrounded it since its approval in the year 2000. Its implementation has furthermore impelled scientific development in diverse fields, such as hydrology, ecology, and economics.

The WFD prescribes the use of economic analysis both to support decision making and as an instrument to reach the objective of sustainable water use in Europe. The economic content of the Directive is therefore crucial for its implementation. However, the public debate about the economics of the Directive has largely

focused on only one of the economic issues, namely that of water pricing and the cost recovery principle.

The initial implementation of the economic instruments of the Directive by Member States has been applied with different degrees of quality by member states. Main results have been the estimation of price levels for cost recovery of water services (art. 9 of the Directive) and the economic characterization of water uses in the river basin districts (art. 5). These achievements were possible because of strong coordination between Member States, and between the relevant sectors within Member States. The results of these efforts in Spain are summarized in the synthesis reports from the Ministry of the Environment (MARM, 2007a; 2007b).

Although the outcomes of the economic characterization of water services and the stimulation of the public discussion about the cost recovery principle are already a remarkable achievement of the WFD, there are important issues left to explore. This survey on the current state of the economic analysis related to the WFD presents those matters that still need to be resolved.

The WFD recognized the need of conducting a prospective analysis of water supply and demand at future planning dates and explicitly proposes to integrate the effects of climate change into its prospective analysis. Indeed, climate change will pose big environmental and social challenges to the European Union and will especially affect the future management of water resources. This is also of relevance to Spain; in general for the whole society, and very specifically for non-irrigated and irrigated agriculture. Technical and economic aspects of water saving technologies

and adaptation to climate change have not been explored thoroughly in the scientific field and even less experience exist with regard to their practical implementation. Climate change maybe a remarkable source of uncertainty but many others should be also considered in the prospective analysis: economic crisis, CAP reform, etc.

The main objective of this paper is to show the current status of economic analysis in the WFD and its main challenges. In this paper we analyze the role of economic analysis in the WFD and the results of its implementation in Spain. Also we will present the current challenges for the economic analysis in the WFD. Therefore, this paper is divided into three parts. First, we analyze the role of economic analysis in the WFD. Then, the main results compared with all EU countries. Finally we show the challenges of economic analysis in the framework of river basin plans.

2. ECONOMIC ANALYSIS IN THE WFD

The overall objective of the WFD is the achievement of a good ecological status in all EU water bodies. To reach this objective, five strategic lines have been set out:

- To prevent further deterioration and to improve the quality of aquatic ecosystems.
- To promote the sustainable use of water resources in the long term.
- To reduce pollution and harmful emissions to surface water.
- To reduce pollution of groundwater.
- To mitigate the effects of floods and droughts.

Under the formal calendar of the WFD, its objective must be reached in 2015, although this

deadline can be extended under certain conditions set down in the Directive.

As stated in the introduction, the WFD prescribes the use of economic analysis both as a support for decision-making and as an instrument itself to help reach its goals. Specifically, economic analysis has eight functions in the context of the WFD:

1. The economic characterization of activities that have a significant water use in the river basin.
2. The prospective analysis of water supply and demand at future planning dates of the Directive (2015, 2021, 2027), and of the decisive factors that will assert pressure on water use at these dates.
3. The estimation of water prices that would allow cost recovery of water services, and the analysis of the economic and social implications of these prices.
4. The evaluation of the effectiveness of water pricing for giving incentives to reduce pollution and improve water use efficiency.
5. To perform cost-effectiveness analysis for the Programs of Measures, including an analysis of the direct and indirect effects of the measures.
6. To perform a survey analysis to identify those water bodies in which the costs to attain the environmental improvements are disproportionate, in order to allow exemptions regarding deadlines and/or environmental objectives.
7. To support the selection of specially protected areas for aquatic species.

8. To support the selection of heavily modified water bodies.

In Spain, in the first phase of the implementation of the WFD between 2000 and 2007, work has been focused on functions 1, 2, 3 and 5 above:

A) Economic analysis of water uses

Water use and the environmental and social impact of irrigation is a topic that has been debated extensively. In the context of the WFD, a synthesis document related to Article 5 of the Directive was prepared by the Ministry of the Environment (MARM, 2007b). The analysis of water uses covers both the present situation and prospectively looks at the situation in 2015. The latter part is currently being concluded.

The prospective analysis will also look at the current and future effects of climate change on water bodies and water uses. For information about these effects at the world level, we refer the reader to the reports from the Intergovernmental Panel on Climatic Change (IPCC, 2007). In the European context, there are the "Climate Change and Water Adaptation Issues" report from the European Environment Agency (EEA, 2007), the report "Climate Change and the European Water Dimension" (JRC, 2005), and several reports by the European Commission. In the national context, we can refer to the work of Iglesias *et al.* (2007).

B) Water pricing and cost recovery analysis

The analysis about water pricing and recovery costs in Spain has been synthesized in a report by the Ministry of the Environment (MARM, 2007a). This report shows that the Spanish Water Law (Real Decreto Legislativo 1/2001) applies a cautious approach to the use of water prices for cost recovery. A base price is calculated to allow paying-off hydraulic infrastructure and the cost is

passed on to those users that can be identified to benefit from the investment. However, this system is mainly designed for services that directly depend on infrastructure, such as surface water using reservoirs, and there is a need to adapt the economic rules of the Water Law and homogenize pricing systems before full cost recovery will be possible.

The debate on the water price has promoted a multitude of studies, especially in the agricultural sector which is the main water consumer in Spain. Most of these studies look at the impact of water price increases on water demand for irrigation. For example, see Gómez-Limon *et al.* (2002), Berbel and Gutierrez (2004) and Albiac (2002).

C) Cost-effectiveness analysis for the selection of measures for the river basin plans and other economic methods

The WFD aims to reach the good environmental status of water bodies by using the most cost-effective combination of measures, this rule can be defined as a lexicographical function. Applications of cost-effectiveness analysis (CEA) relating to the Programs of Measures are scarce in both Spain and Europe. In Spain the Catalan Agency for Water, and the river basin authorities of the Guadalquivir and the Ebro did carry out CEAs, and they will be presented with the basin plans in March 2010. See Berbel *et al.* (2009) for additional information.

3. THE CURRENT CHALLENGES FOR ECONOMIC ANALYSIS

In spite of the important work that has already been accomplished in the first phase of the WFD, many challenges remain. These include:

- The assessment of the methods that have been developed and applied so far for the

selection of measures that are included in the Programs of Measures. According to the WFD, cost-effectiveness analysis is supposed to play a key role in this selection in order to achieve the proposed environmental objectives at the lowest cost. However, a review of the published Programs of Measures of other Member States makes clear that instead of applying CEA and basing derogations on analysis of disproportionate costs, what seems to prevail in the plans are measures chosen for their feasibility and affordability (*i.e.* not exceeding budgetary capacity).

- A common methodology for the analysis of cost recovery calculations, with special attention given to the inclusion of environmental and resource costs. The environmental and resource costs of water have not been given much attention in the economic analyses of the first phase of the WFD. In the Aquamoney project a start was made to estimate these costs. However, research should be continued in the next few years in order for environmental and resource costs to be internalized in the water prices for different users. This will make water users include the externalities of their water use in their decisions and will contribute to a sustainable use of the resource.
- To evaluate the incentive effect of water pricing as a measure to reduce pollution and stimulate the efficient use of water. The WFD sets an early deadline for 2010 when Member States will have to guarantee that water pricing policies provide appropriate incentives for water to be used efficiently and, therefore,

contribute to the environmental objectives of the Directive. These pricing policies should be applied to all water users, such as industry, households and agriculture (Art. 9).

- The establishment of guidelines for the assignment of derogations, based on the existence of disproportionate costs. Whether a disproportion exists, i.e. when benefits for society are lower than the costs of implementing measures, should be determined by cost-benefit analysis (CBA). While applications of CEA in relation to the WFD are scarce, the situation is worse for CBA. The latter is one of the instruments the WFD proposes to determine whether the costs of reaching the ecological objectives are disproportionate and, therefore, whether derogations from the objectives or extensions of the deadline should be granted. We comment this issue under the next section.
- The introduction of new mechanisms to deal with water scarcity and drought. Institutional measures and performance protocols need to be established by water authorities and water users. We also comment the use of new economic instruments in the next section.
- The exploration of mechanisms to estimate the costs of adaptation to climate change – fundamentally to an increase and escalation of drought occurrences – and the incorporation of these mechanisms in the revision phase of the WFD and in the emergent drought

policies in Europe. The evaluation models and economic analysis will also need to allow for climate change uncertainty.

- The identification of areas in need of special protection. Economic analysis and especially environmental valuation can play a major role in this regard. This is already being developed for the national park Tablas de Daimiel.
- To support the selection of those water bodies to be considered “heavily modified”. The WFD allows exemption from the environmental objective of reaching the good ecological status for water bodies that are considered artificial or heavily modified. Less stringent environmental objectives are set for these water bodies. To qualify for this the water body needs to be “so affected by human activity” or must have such a “natural condition” that to reach the most demanding objectives is unfeasible or has a disproportionate cost.
- To take uncertainty into account in the estimation of pressures, costs and impacts of the measures that are considered in the Programs of Measures.

4. RESULTS OF THE ECONOMIC ANALYSIS PERFORMED IN SPAIN IN COMPARISON WITH THE REST OF EUROPE

In March 2007 the European Commission presented the WFD’s first results, together with an appraisal of the first steps of its implementation (European Commission, 2007b). This appraisal

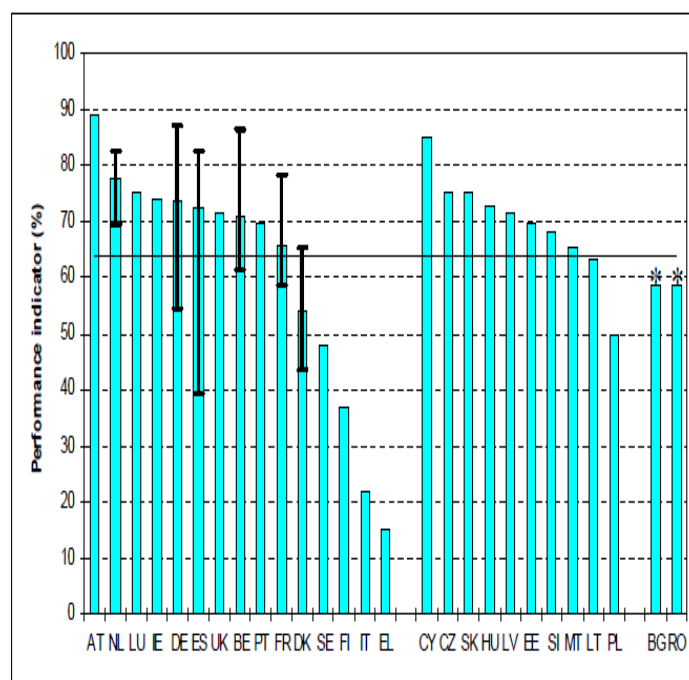
identified a high number of water bodies that were at risk of not complying with the objectives in 2015, especially those in highly populated regions with an intensive and non-sustainable use of water.

The WFD requirements regarding environmental and economic analysis are stipulated in Article 5 of the Directive. According to this article, Member States need to implement a triple analysis for each river basin, or for the part which pertains to its territory in case of international rivers basins. The three parts are:

- a) An analysis of the river basin characteristics.
- b) An analysis of the state of the surface and underground water bodies.
- c) An economic analysis of water use.

The EC's appraisal found that all Member States had more or less applied the Article 5 analysis as intended. However, Member States' reports did show important differences in quality and level of detail. Figure 1 shows the level of compliance for each Member State.

Figure 1. Member State performance indicator of the overall implementation of the environmental and economic analysis (Article 5)



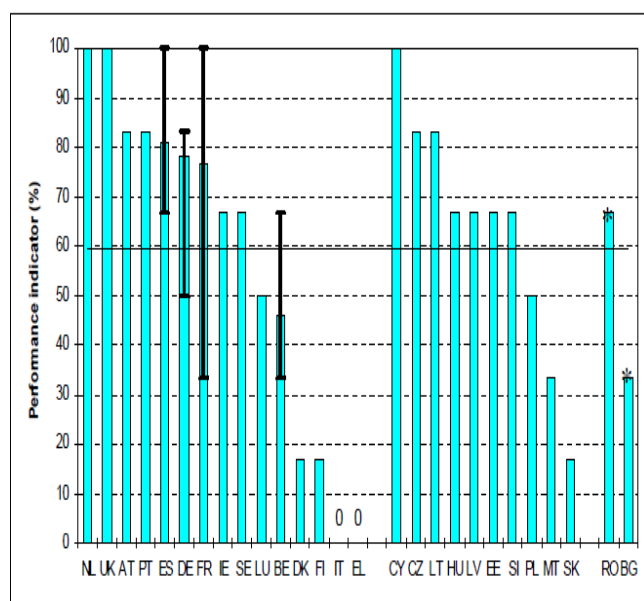
Source: European Commission (2007b, p. 36).

For those Member States that provided separate reports on their river basin districts, the black lines indicate the range of compliance for the different reports. The UK and Poland also provided separate reports, but these received the same score with regard to the environmental and economic analysis. *The scores for Bulgaria and Romania are based on preliminary assessments.

Six countries, including Spain, show a high degree of compliance. The Spanish reports scored between 40% and 85% depending on the river basin, and 72% overall. Spain's overall compliance is about 10% higher than the European average. These results correspond to both the environmental and economic analysis. Regarding the degree of compliance of the economical analysis alone (point c above), the European Commission was not satisfied.

The economic analysis of water use is supposed to contain enough information to allow both the calculation of water prices for cost recovery and the execution of a cost-effectiveness analysis of the Program of Measures. For various Member States this economic analysis was the weakest part in the Commission's appraisal. The results of cost recovery calculations and water use analyses show the need for more and better information. The European Commission also specifically identified that the analysis of environmental and resource costs was neglected by many States Members. Figure 2 shows Member States' performance on the indicator related to the economic analysis of Article 5.

Figure 2. Member State performance indicator of the economic analysis of Article 5



Source: European Commission (2007b, p. 40).

This performance chart is based on only three questions related to the economic analysis: Is information provided about the level of cost recovery?; Is there an overview of the socio-economic importance of water uses in relation to their pressure on the water bodies?; Is a baseline scenario established? It does therefore not relate

to all requirements in Annex III. For those Member States that provided separate reports on their river basin districts, the black lines indicate the range for the different reports. The Netherlands, Poland, and the UK also provided separate reports, but these received the same score on this indicator. *The scores for Bulgaria and Romania are based on preliminary assessments.

Only the Netherlands, the United Kingdom and Cyprus scored 100%. At the other extreme, Italy and Greece scored zero points. For Spain, considerable differences were found between the river basin reports. The provided information and the executed analyses of some river basins lie below the European average (59%), while many other river basins have provided all necessary information and undertook the full analysis required by Article 5. Overall, the economic analyses carried out in Spain are among the best in Europe regarding execution and methodological application.

5. FUTURE PROPOSALS FOR ECONOMIC ANALYSIS IN THE WFD

In the coming phases of the WFD, economic analysis will be applied to determine the cost-effectiveness of the Programs of Measures, make calculations for cost recovery and water pricing, assess potential derogations from environmental objectives, and estimate and incorporate uncertainty and costs related to climate change.

While the cost-effectiveness analyses were already performed in the first phase of the WFD, it might be necessary or convenient to return to them in more advanced stages of the river basin planning process to evaluate the effects of introducing or eliminating a particular measure, evaluate different financial strategies or consider

changes in other variables. The analyses need to be kept up to date, or they may lose their validity. De Nocker (2007) makes a full cost benefit analysis of WFD implementation.

The economic analysis in the WFD should be applied to insure, among other objectives, that measures applied to improve water status (achievement, in 2015 of good ecological status of water bodies) are the most cost-effective. The first reviews on the implementation of the DMA showed costs of several billion euros, but in many cases proper cost effectiveness analysis leading to choosing the most economical measures have not been implemented. In Spain this was partly because many measures had already been decided by competent authorities and/or were already being implemented. The real costs of implementing the WFD, after proper cost-effectiveness analysis, remains to be calculated. Some agencies and organizations consider that there is a need to undertake a cost-benefit analysis (CBA) to consider the advisability of some of the measures.

From our point of view, there are four additional groups of measures – economic instruments – that should be analyzed in the coming years.

- A) The first group of measures consists of temporary adjustments (seasonal or annual) of water prices, which can have different purposes. For instance, a case can be made for seasonal prices in coastal areas where demand doubles during the summer. The extra supply effort requires that all infrastructure is dimensioned for peak time demand. Temporary price adjustments could also

give an incentive to regulate water use when faced with an exogenous reduction of supply, for instance as a result of a drought. Prices may be temporarily adjusted to reflect scarcity and be reduced later when supply returns to normal levels. The interaction between supply measures and pricing should receive close attention in cost-effectiveness analyses.

- B) Measures relating to markets and water rights trading. Participation in these markets should be voluntary as is the case with the existing Water Use Rights Exchange Centers that have been established in Spain since 2005. However, actual water rights trading remains scarce. It is important to make sure that when these instruments are used, the environmental effects of reassignment are also considered. The same goes for the social effects of the potential displacement of less productive uses from areas with a low economic activity.
- C) Maybe one of the most important economic instruments for agricultural risk management is insurance. Insurance is taken out to cover many risks, such as of frost, hail, fire, and also drought, but absent as yet to cover water needs in Spanish irrigated agriculture. At this time agrarian insurances only cover drought risks for un-irrigable land. In fact, traditionally the aim was to neutralize the

effects of hydrological variability on farmers by improving irrigation infrastructure. There is a need to explore the cost-efficacy of insurance schemes to cover the water need for irrigation.

D) The analysis of Spanish case study shows that CBA analysis has not been applied with a sound methodology for the analysis of exceptions and disproportionate cost as should be done following Directive.

One of the biggest challenges in connection with the use of these economic instruments is that related to the pricing systems. The current literature, following market theory, suggests that water use will be more efficient when price differentiation is lower and demand elasticity is higher. Water tariff structures based on marginal costs would lead to the optimal use of the existent capacity (Chesnutt *et al.*, 1995), and the rationalization of investments (Trujillo, 1994). However, using uniform tariffs based on marginal cost in the case of water services would not be a good approach in terms of efficiency. The existence of economies of scale and other market failures in the provision of these services make that the marginal costs are lower than the average production costs (Barberán *et al.*, 2008). Prices based on marginal costs would therefore not be financially sustainable in the long run. To establish price structures that would allow the proposed environmental objectives to be achieved through an efficient use and conservation of the resource; we will have to start by better analyzing the current situation. Very important in this will be to determine the elasticity of water demand for each water use.

6. CONCLUSIONS

In this paper the current state of the economic analysis in the context of the WFD in Spain has been discussed. The most important elements of the analysis undertaken up to now have been highlighted, and the extent to which they have achieved the outlined objectives has been presented. The latter has been compared to results in the other EU Member States. The outcome of this comparison showed that Spain has performed well in the first phase of the WFD.

Furthermore, the goals for economic analysis in the next stages of the implementation of the WFD were outlined, and, finally, the great challenges that water management will present to the economic science in the future were highlighted.

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